AFOSR-TR- 80-0332

STUDIES IN SYSTEMATIC INSTRUCTION
AND TRAINING

(11)

P.S.

Performance Objectives

LEVEL II

AD A084925

Vernon S. Gerlach
Robert C. Haygood
Gary L. Filan
Richard F. Schmid
Dianne L. Wigand
William V. Hagin

DTIC
ELECTE
JUN 2 1980
S D
C

Approved for public release;
distribution unlimited.

USAF Office of Scientific Research

Grant No. 76-2900

ARIZONA STATE UNIVERSITY
EDUCATIONAL TECHNOLOGY

DDC FILE COPY

THIS DOCUMENT IS BEST QUALITY PRACTICABLE.
THE COPY FURNISHED TO DDC CONTAINED A
SIGNIFICANT NUMBER OF PAGES WHICH DO NOT
REPRODUCE LEGIBLY.

Technical Report #812[illegible]02

80 5 14 049

DISCLAIMER NOTICE

THIS DOCUMENT IS BEST QUALITY PRACTICABLE. THE COPY FURNISHED TO DTIC CONTAINED A SIGNIFICANT NUMBER OF PAGES WHICH DO NOT REPRODUCE LEGIBLY.

UNCLASSIFIED
SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE	READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER (19) (18) AFOSR TR-80-0332	2. GOVT ACCESSION NO. AD-A084925	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) (6) Performance Objectives	5. TYPE OF REPORT & PERIOD COVERED (9) Interim rept.
	6. PERFORMING ORG. REPORT NUMBER 81202
7. AUTHOR(s) (10) Vernon S. Gerlach, Robert C. Haygood, Gary L. Filan, Richard F. Schmid, William V. Hagin, Dianne L. Wigand	8. CONTRACT OR GRANT NUMBER(s) (15) AFOSR-76-2900
9. PERFORMING ORGANIZATION NAME AND ADDRESS Arizona State University Tempe, AZ 85281	10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS 61102F (16) 2313/A2
11. CONTROLLING OFFICE NAME AND ADDRESS Office of Scientific Research (NL) United States Air Force Bolling AFB, DC	12. REPORT DATE (11) Dec [redacted] 78 13. NUMBER OF PAGES 79
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office) (17) A2	15. SECURITY CLASS. (of this report) Unclassified 15a. DECLASSIFICATION DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report) (12) 83

Approved for public release; distribution unlimited.

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

(14) TR-81202

18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Behavioral objectives
Instruction
Instructional systems design
Objectives
Performance objectives
Training
Training objectives

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

The literature on performance objectives is reviewed under the following headings: definitions of performance objectives; function of performance objectives; pros and cons of performance objectives; and form of performance objectives. The review indicates a general agreement, unsupported by research, that performance objectives have value for learners, instructors, and designers; that there is no operational definition of the term performance objective; and that, although there is general agreement →

DD FORM 1473

409989

UNCLASSIFIED

regarding the three formal characteristics of a performance objective, examples of performance objectives still differ greatly from one another in form. The results of six original studies are reported.

Study 1 supplied us with normative data regarding the "observability" of 99 frequently recommended verbs, a replication of Deno and Jenkins (1969). The results confirmed their findings, but carried with them, as had previous studies, the implication that the verb is the only part of the objective worth considering. Study 2 began an examination of the effect of other parts of the objective, i.e., conditions and/or criteria, on the already established "observability" of the verbs in Study 1. Both components were found to affect the nature of the objective as well as the perceived precision of the verb, often in a highly significant manner. Study 3 further developed the role of the three components of performance objectives. These data suggested that the observed precision of an objective results from an interaction of all three parts, and that analyses of the components in isolation are meaningless. The search for unaccounted-for variance in the overall observability of objectives led to an examination of yet another segment, the direct object. The objectives employed in Studies 1 through 3 used an abstract direct object ("x" or "y") in order to minimize differential effects. In Study 4, direct objects varying in judged degree of specificity were incorporated into the objectives and tested for their specific and general effects. The direct objects were found to contribute important additional information to the reader in terms of both observability and precision, following the linear relation anticipated by the gradations in specificity. Interestingly, comparisons of objectives with either abstract or concrete direct objects produced no overall significant difference, suggesting that readers had naturally substituted concrete modifiers for the abstract direct objects in order to "complete" the objective. An acceptable performance objective, therefore, should contain not only a verb denoting an observable behavior, but also appropriate conditions, criteria, and clearly stated or easily inferred direct objects. The fifth study represented an attempt to determine whether or not the previous results could be extended to a specific target population -- that of military personnel (both trainees and trainers). Quite simply, the similarity of the military personnel responses to those of the earlier studies (college students) on the verb rating tasks strongly supported the generalization of conclusions. Further information on similarity of interactive effects will be required to provide a blanket acceptance of transferability. The final study in this report constituted yet another ill-fated attempt to surface an observable function of objectives. As Illich (1973) so tactfully warned, "...alchemists failed no matter how often they tried, but each time their 'science' yielded new reasons for their failure, and they tried again." Indeed, through the pale of nonsignificance, a hopeful glimmer did occur. The observers in this study were asked to pass judgment on the "clarity" with which the teacher disseminated the information. While one supposes that teachers employing objectives would behave with corresponding precision, such was not the case. Nevertheless, it was discovered that the trained observers could effectively identify those groups which would more likely achieve. The presence of performance objectives appears less important than the behavior assumed to be associated with the use of objectives. While this finding is by no means surprising, it may suggest that reasearchers should abandon the mehtods currently in vogue in studies designed to ascertain the function of objectives in instruction. It is unlikely that any study will profoundly alter the basic teaching behaviors of the subjects.

(1)

Rule Learning and Systematic Instruction in Undergraduate Pilot Training

Vernon S. Gerlach, Principal Investigator

PERFORMANCE OBJECTIVES

Vernon S. Gerlach
Robert C. Haygood
Gary L. Filan
Richard F. Schmid
William V. Hagin
Dianne L. Wigand

Technical Report #81202

AIR FORCE OFFICE OF SCIENTIFIC RESEARCH (AFSC)
NOTICE OF TRANSMITTAL TO DDC
This technical report has been reviewed and is
approved for public release IAW AFR 190-12 (7b).
Distribution is unlimited.
A. D. BLOSE
Technical Information Officer

Research sponsored by the Air Force Office of Scientific Research, Air Force Systems Command, USAF, under Grant No. AFOSR [redacted]. The United States Government is authorized to reproduce and distribute reprints for governmental purposes notwithstanding any copyright notation hereon.

76-2900

College of Education
Arizona State University
Tempe, Arizona

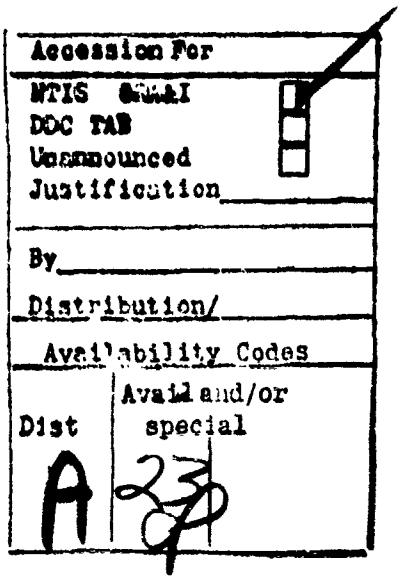
December, 1978

Copyright © 1978
Arizona State University
All rights reserved

PERFORMANCE OBJECTIVES

Acknowlegment

Many graduate students at Arizona State University made contributions to the studies here reported. Several of the more significant contributions came from Fritz Brecke, Brian Shipley, Maryann Barron, Robert Reiser, Scott Herrington, and Larry Israelite. Barbara Celaya has performed far beyond the call of duty as typist and secretary throughout the years of the several studies. Norman Higgins and Harold Hunnicutt provided valuable administrative support. Although Dianne Wigand is a co-author, because of her cooperation on various studies, it should be particularly noted that she carried out the design and data collection and analysis for Study 6 without OSR and ASU support.



Performance Objectives

Maintaining readiness through training is the single most important military peacetime activity-- and one of the most expensive. Today over half the defense budget is for "people" costs, of which a substantial portion is related to training.

To insure that training programs are cost-effective, all the military services now use the systems approach to instructional program development. Guidelines for following the systems approach, or, as it is now nearly universally referred to the Instructional Systems Development process, are provided in several service manuals, pamphlets, and training packages. Without exception, all of these are "objectives-based," i.e., they proceed from the assumption that both good training and good assessment (or evaluation) must be based on well-stated performance objectives.

Nor is it military training alone which ascribes this crucial role to performance objectives. Both business and education have done so, too. In these areas, the term behavioral objective is used more frequently than the more familiar performance objective. Performance objectives provide a basis for designing curriculum, for developing training materials and procedures, and for generating tests or performance measures. They have been used both to tell trainees what is expected of them and to judge whether or not trainers (or training systems) are accomplishing what is expected.

Despite the almost universal acceptance of the concept of performance objectives, there remains a wide range of viewpoints concerning both what they are (form) and what purpose they serve (function). There is

remarkably little empirical research reported in this area and what research there is has not yielded significant support for the use of performance objectives for any purpose. The same questions which Ausubel (1963) raised concerning discovery learning apply to the current performance objectives "bandwagon." He pointed out that a careful review of the literature yields three conclusions, which, in view of the wide acceptance of discovery learning, are most disheartening. The three applied to the area of performance objectives, are these: First, most of the articles commonly cited as reporting results supportive of performance objectives actually report no research findings whatsoever but consist mainly of theoretical discussions, assertion, and conjecture; of descriptions of existing projects or systems utilizing performance objectives; and of enthusiastic but wholly subjective testimonials regarding the efficacy of performance objectives. Second, most of the reasonably well-controlled studies report findings which fail to support the contention that the performance objective is an effective independent variable. Finally, most studies reporting positive findings either fail to control other significant variables or employ questionable techniques of statistical analysis. Thus, actual examination of the research literature that allegedly supports performance objectives reveals that valid evidence is virtually nonexistent. It appears that the various enthusiasts for performance objectives have been supporting each other research-wise by taking in each other's laundry, so to speak, that is, by citing each other's opinions and assertions as evidence and by generalizing enthusiastically (if not wildly) from equivocal and even negative findings.

Let us, then, examine the literature. First, we shall look at the attempts to define performance objectives; then we shall consider the form of performance objectives; finally, we shall study the functions of performance objectives.

Definitions of Performance Objectives

Basically, all writers refer to the performance objective as a statement describing a final behavioral state of a learner. If learning is considered, quite broadly, as a relatively permanent change in a learner's behavior following instruction (Gerlach & Ely, 1980), then a performance objective is nothing more or less than a statement of what someone should learn or is learning. Whether such statements are referred to as objectives, aims, goals, intents, or outcomes, they must refer to the intended change one wishes to produce in a learner (Popham, 1969). Both Bloom et al. (1956) and Mager (1962) define performance objectives in terms of change in a learner.

Frequently a performance objective is closely associated with subject matter. A student pilot learning basic navigation cannot acquire the required skill without some degree of proficiency in meteorology. A performance objective in this context must specify not only the terminal behavior, but also the particular aspects of the subject matter to which the learner must address himself in order that the desired learning may occur (Gagné and Briggs, 1979).

Some writers have attempted to use <u>operationism</u> as a guide for constructing performance objectives. Operational definitions have done

much to reduce ambiguity in the language of the hard sciences. Tiemann (1977) asserted that performance objectives are abstract concepts defined in terms of a number of instances drawn from the cognitive, affective, or psychomotor domains. Theoretically, this kind of objective should yield excellent results. Practically, however, it founders on the shoal of precisely those questions which plague "hard" scientists: What exactly counts as an operation? What happens to the concepts when we are not performing operations or if we have not yet learned how to perform them (MacDonald-Ross, 1973)? Hempel (1965) pointed out that activities, events, and attitudes that are not ascertainable by direct observation have an important and valid place in the educational system. For instance, in the fine arts it is extremely difficult to specify an observable behavior when judgment, feeling, and creativity play a major role. Similarly, when we think of pilot training, we quickly encounter analogous problems: how does one write a performance objective in operational terms to deal with such elusive, but nevertheless crucial, factors as pilot judgment or pilot feeling? Perhaps, as MacDonald-Ross asserted when speaking of subjects such as art, there are no ultimate goals to be reached, but rather standards or judgment to be developed; these kinds of broad goals represent a type of behavior which, since it is internal, is not observable and consequently not highly amenable to the constraints which operationism imposes on those who would define performance objectives. Similar concerns in areas dealing with originality, self-discovery, and creativity have been voiced by Eisner (1967) and Burns (1972). Frequently, the only evidence concerning judgment is the <u>failure</u> to make certain kinds of mistakes!

Functions of Performance Objectives

Instructional Systems Design manuals deal with three categories of functions of performance objectives: (1) an aid to the design of efficient instructional or training systems; (2) an aid to evaluating instruction, (3) an aid to the student.

Design. Objectives provide a point of departure for planning an instructional program or a training system. When designing a system or program, one needs to know what a successful solution will look like as well as what criteria must be satisfied. Performance objectives may provide the only possible rational basis for evaluating the success of the learning experience. The system or program is successful only when students can demonstrate satisfactorily what the objectives predicted. If these assumptions of MacDonald-Ross (1973) are valid, then performance objectives can be used as guidelines for the design of instruction.

A systematic procedure for developing objective-based instruction has been developed by Gagné and Briggs (1979). They stated that when objectives are known, one is able to infer what kind of learned capability is being acquired and what conditions will be needed to bring about the learning with greatest efficiency. Clearly, then, the systematic design of lessons which make up courses will result in the development of a sizeable collection of statements of objectives. Higher level objectives will be formulated which will depend on the acquisition of lower level objectives or prerequisite skills. The identification of performance objectives makes possible the classification of capabilities into useful categories. Without these categories, we can deal with learning principles

only on a very general basis. With them, it becomes possible to infer what kinds of learned capabilities are being acquired at any given point in the learning process. One can also determine under what conditions (internal as well as external) the learning experience takes place.

The model developed by Gagné and Briggs is tied closely to Gagné's brand of educational psychology. The hierarchy (problem solving, rule learning, concept learning, discrimination, etc.) has been described in his Conditions of Learning (1977). It seems quite unlikely that one can apply the Gagné and Briggs model to design problems without some knowledge of Gagné's more theoretical work. A simpler model, also objective-based, is that of Dick and Carey (1978). They clearly state that the first step in building a module of instruction is to state the instructional goal, a term which is nearly, if not exactly, synonymous with performance objective. They use the goal statement as the basis for conducting an instructional analysis, for specifying entry behaviors, for generating test items, and for developing instructional strategies and materials. The Dick and Carey model, while simpler to apply than the Gagné and Briggs model, is by no means a simplistic one.

While there are many other objective-based models for instructional design, essentially all of them emphasize the same components as do the two cited. Indeed, two hundred years before the advent of performance objectives, educators (e.g., Herbart, Pestalozzi) had pointed out that good teaching consists of determining one's goal, adopting a course of action which leads to that goal, and determining whether or not the goal has been attained. Performance objectives have not changed this model;

they may have increased its power by bringing greater precision to the first element. Mager (1962) certainly thought so; he described the three elements in these terms:

> (1) Where am I going?, which refers to how to achieve the objectives; (2) How will I get there?, which refers to how to achieve the objectives; and (3) How will I know when I've arrived?, which is the evaluation process of determining whether or not the student has satisfactorily achieved the objective.

Note well that the word objective is the ordinate word in both Statements 2 and 3!

Emphasis has been placed on the performance as the point of departure. A number of instructional designers have protested that this is too restricted a view of the design process, that the design process can move ahead even with only imperfectly formulated performance objectives. MacDonald-Ross (1973) suggested that the designer should do his best in developing objectives, then move on to the development of end-of-unit tests, and then select and develop the instructional materials. This procedure would be carried out until each component has been specified as clearly as possible. At this point one would develop a first draft; quite frequently there will be changes in some of the objectives. But of course one would be doing this on the basis of evidence, rather than on the basis of some vaguely conceived or haphazard scheme. It is well understood that although objectives are intended to be a basis for prescribing course structure and evaluation, frequent adjustments must be made in practice.

Not all instructional technologists are agreed that performance objectives are an unmitigated blessing for the instructional designer. Baker (1974), for example, observed that the use of behavioral objectives

forming a basis for restructuring instructional programs may have some negative consequences. Because objectives are stated in operational language, they appear to be more teachable. Objectives may look achievable if they follow the formula: "Given..., the student will be able to...", but such is not always the case. Because it is easy to transform goals into the accepted behavioral objectives format, examples of learning may be casually produced. Baker stated that many supervisors and curriculum specialists feel that as long as the behavioral verb has been supplied, there is little to criticize. She also questioned whether most behavioral objectives present sufficient cues regarding how a teacher should alter instruction in order to facilitate improved learning.

Objectives help as a stimulus to clear thinking by forcing teachers to think in specific terms rather than in vague ambiguities. MacDonald-Ross (1973) felt that this is a prerequisite for any system of design or planning and that such thinking yields the additional benefit of revealing value judgments that might otherwise remain concealed. Once externalized, such thinking can be subjected to criticism and testing, and thus instruction can be improved. If objectives can provide a stimulus for clear thinking, they ought to have the potential of helping teachers develop instructional strategies and methods.

Evaluation. Since performance objectives are descriptions of what must be observed in order to verify that learning has occurred, they should provide a basis for the development of tests or assessment procedures, both for determining learner progress and for assessing the quality of the instructional system. Objective-based assessment need not occur only at the completion of a program or unit. Briggs (1970) stated that

objectives are useful for determining whether or not students need remedial work. Obviously, tests on specific objectives serve as a guide for determining whether the student is ready to go on to the next objective; tests for units of instruction can reveal the learner's mastery of more complex objectives or of clusters of objectives; end-of-course tests can indicate the students' ability to solve more complex problems or to apply their knowledge to a wider range of situations. Objective-based tests can also be used prior to instruction to help in identifying students who lack the prerequisites needed to succeed (Gagné and Briggs, 1979) as well as to identify those who need no instruction because they've already attained the objective.

Aid to students. When behavioral objectives are given to a student prior to instruction, they may provide guidance to the student in processing information. Deterline (1968) said that if students are told precisely what the objectives are, in the form of minimum performance requirements, and if they are given sample test questions, performance can be improved. If behavioral objectives are used to tell the student exactly how he is going to be tested, anxiety may be diminished.

Performance objectives may [illegible] direct students' learning (Duchastel and Merrill, 1973; Kapfer, 1970; Kibler et al., 1974), since such objectives may provide organization or general structure for the subject matter. Duchastel and Merrill also pointed out that objectives may serve a management function by enabling the students to organize their time and learning experiences better in terms of the goals of the course. This might help eliminate the typical cramming sessions which often precede tests, though hard evidence is as yet lacking. Another function is that

of providing learners feedback in terms of the criteria set forth in the objective, enabling students to deal with any discrepancies between performance and goal. Finally, presenting objectives to students may help to motivate them. Students who know that they have satisfactorily met the criteria set forth in the objective will probably be more motivated than students whose only reinforcement comes from a grade at the end of a course. Duchastel and Merrill also pointed out that presenting objectives to students will have no results if the students pay no attention to them in the learning situation. Therefore, a teacher must make an effort to explain thoroughly the meaning of objectives to students so that they will actually use them while learning. However, the teacher must also avoid giving students such long and extensive lists that they are overwhelmed or confused.

Gagné and Briggs (1979) agree that the advantage of providing objectives to students is that it informs the learners of their goal. They disagree with those who contend that when an instructor gives an objective to students, they may be inhibited from trying to meet still other worthwhile objectives which they may formulate themselves.

Pros and Cons

The arguments for and against the use of performance objectives are usually advanced in terms of three criteria:

To what extent do they help a student? (When students are given performance objectives, do they perform any better?)

To what extent do they help a teacher? (When instructors are given performance objectives, or trained to generate performance objectives, do they instruct any better? or do their students

learn more and/or faster?)

To what extent do they help an instructional designer? (When ISD personnel are given performance objectives, or trained to generate their own, do they design better instruction?)

As we have mentioned earlier, the published research is both meager and mediocre. Nevertheless, even though we cannot find definitive answers to these three questions in the literature, we can identify (albeit tentatively) apparent trends; even more important, the literature clearly leads us to several research endeavors.

Students. Several studies have yielded data that led their authors to conclude that students who have performance objectives prior to instruction achieve more, in terms of posttest performance, than do other students (Bassett and Kibler, 1975; Dalis, 1970; Doty, 1968; Lawrence, 1970; Engel, 1968; Blaney and McKie, 1969; Tieman, 1968). Aside from other deficiencies, not one of these studies included an operational definition of the independent variable. It hardly seems necessary to call attention to the irony: experimenters conducting research on the value of communicating to learners in clear and unequivocal terms the purpose of the instruction themselves fail to provide a clear and unequivocal definition of the phenomenon under investigation. The fact that a considerable number of studies indicates that availability of performance objectives to students makes no significant difference (Boardman, 1970; Smith, 1967; Weinberg, 1970-- to mention only three) and that another considerable number indicates that students who were provided performance objectives prior to instruction performed less well on a posttest than did other students (Olson, 1971; Yelon & Schmidt, 1971; Stedman, 1970) adds nothing to our knowledge; these studies, too, are plagued

by the same deficiency -- lack of a definition of a performance objective. Duchastel and Merrill (1973) and MacDonald-Ross (1973) intimated, if they did not so state, that one could not use the information included in most published articles to determine whether a given statement is or is not a performance objective. Some of these studies used Mager's three criteria; this is no help, for one can adhere strictly to these criteria and still produce a set of objectives which, at best, would be classified as examples of a gross and unanalyzed variable.

Another problem that most studies of this type have failed to recognize is that level of specificity may be critical. MacDonald-Ross has pointed out that there are no rules for determining degree of level of specificity. Clearly some effort should be redirected toward formulating such a set of rules, lest we discover that availability of performance objectives facilitates learning, and then have no use for the findings because we do not know how general or how specific to make the performance objectives.

There seems little point in analyzing the studies in terms of design and statistics; good design and statistics are worthless if the independent variable cannot be reproduced or replicated.

Teachers. There appears to be an even greater dearth of empirical evidence to support the hypothesis that performance objectives help teachers teach better, regardless of whether the dependent variable is teacher behavior or student performance. It hardly requires a research study to come to the conclusion that even if instructors are given performance objectives (or taught to construct good performance objectives), their students will not achieve a satisfactory criterion when subjected to bad,

or even mediocre, instruction. Sullivan and Niedermeyer (1977) pointed out (not in a research report!) that if teachers want students to achieve mastery of objectives, teachers must also be provided with instructional materials and procedures developed especially for the objectives of the lesson. Merely providing performance objectives to the teachers may have little effect on either the instruction or the learning. Teachers should not be held accountable for high levels of pupil performance on objectives without the proper development of instructional materials and procedures based on the objectives. They concluded that with the increasing number of objectives-based programs in our schools, there is need for empirical evidence to support the concept of Objective-Based Instructional Programs. We might add that there is also need for empirical evidence to support the widespread claims for the benefits of using performance objectives, period -- but it could be inferred that the authors meant to say this too.

Several studies of the effect of providing instructors with performance objectives are worth examining. Baker (1969) gave teachers objectives in an investigation of the effects of behavioral and non-behavioral objectives on students' achievement. She randomly assigned one of three lists of objectives-- one list non-behavioral, the other two lists behavioral-- to high school social studies teachers and asked them to teach for the attainment of the objectives in their classrooms. No significant differences were found between posttest scores of students in the behavioral and non-behavioral treatment groups. Baker suggested that the teachers' faulty understanding of objectives, indicated by their observed inability to provide relevant classroom practice and to identify appropriate test items, may have accounted for the lack of difference

among the groups. Baker suggested that a replication of the study be conducted with one group of teachers thoroughly trained in the use of behavioral objectives and another group of teachers not so trained.

Jenkins and Deno (1971) investigated whether providing teachers, students, or both teachers and students with general or specific performance objectives increased the amount learned. The results did not support the hypothesis that type (general or specific) of objective affected learning. Furthermore, neither condition was significantly superior to conditions in which performance objectives were not provided. They concluded:

> The possibility remains, however, that type and knowledge of objectives were insignificant variables because they received inadequate attention from both the teachers and the students. Since teachers and students rarely are exposed to the explicit objectives of instruction they might fail to use these objectives appropriately either because their value is not recognized or because one must learn how to use explicit objectives.

Moreover, Jenkins and Deno suggested that more benefit may be derived if teachers and students were given some incentive to use the objectives or were given practice in their use.

The effects of "pre-pared" and teacher-prepared performance objectives on the learning of educable mentally retarded children were investigated by Crooks (1971). He used three groups:

(1) Teachers were given and used "pre-pared" performance objectives;

(2) Teachers prepared and used their own objectives, lesson plans, and activities;

(3) Teachers used their own instructional approach.

Significant differences, in terms of pupils' posttest scores, were found between the groups who used "pre-pared" objectives and those who prepared their own objectives. Students scored higher in the groups who were

taught by teachers who used "pre-pared" objectives. The results indicated an advantage in using "pre-pared" objectives and materials Unfortunately, no mention was made of whether or not the teachers were trained to use the objectives provided.

The next category of studies included the training of teachers in the use of performance objectives and the effect of such training on students' achievement. The type of training and the amount of time devoted to training varied from study to study. In some cases, it was difficult to ascertain the precise nature of the training. Two studies in this group showed that training in the use of performance objectives facilitated students' learning, while two did not. Although some studies failed to find that the training of teachers in the use of objectives increased student learning, there were -- according to the researchers -- some indications that favored this hypothesis.

Piatt (1969) investigated the effect of training teachers in defining, writing, and implementing performance objectives on learner outcomes in a seventh grade mathematics program. In this study he measured mathematics skills, mathematics application, and student attitudes. He used the Stanford Achievement Test to measure mathematics skills and application, and the Hayes Pupil-Teacher Reaction Scale to measure the students' attitudes toward their teachers. In the areas of mathematics skills and students' attitudes, Piatt found that posttest scores of students in the group that received the specific training were significantly higher than those of students in the other group. However, he did not find this effect in the area of mathematics application. Thus, Piatt was able to demonstrate that the training in the use of performance objectives

provided a facilitative effect, in terms of student posttest performance, but not in all subject-matter areas.

Bryant (1970) investigated the effects of performance objectives on the achievement level of low achieving eighth grade science pupils in predominantly black inner-city schools. He found that pupils taught by teachers trained in the use and development of performance objectives achieved higher scores on the criterion measure. In addition, the use of performance objectives appeared to facilitate the presentation of course content in small manageable pieces and it provided more opportunity for the low achiever to experience success in the classroom. However, the criterion measure used in this study was spurious: it was developed by both the trained and the untrained teachers and its validity as a measuring device was questionable.

Cardarelli (1971) provided teachers with training in recognizing and writing objectives, identifying appropriate activities, and constructing test items matched to the objective. Each teacher received the same materials on the topic. Teachers could use all, some, or none of the resources given them. Training did not have a significant effect on students' achievement. Pupils of those teachers who received training but were assigned non-behavioral objectives achieved the highest mean score on the criterion measure. This result was explained by the presumption that teachers have a greater commitment to achievement of a goal when they write their own objectives. On the other hand, pupils of teachers who received behavioral objectives but no training had the lowest mean score on the criterion measure. It was suggested that without training, teachers

do not perceive behavioral objectives and non-behavioral objectives differently; consequently, teachers should be trained but allowed to write their own objectives rather than being assigned objectives. The results of this study contradict those of an earlier study (Crooks, 1971) in which the use of prepared objectives and materials was found to be facilitative.

Clingman (1972) investigated the effect of providing teachers and students with performance objectives on the amount of learning, frequency of course attendance, and student satisfaction. All teachers were given traditional content outlines for each topic. The treatment group, both teachers and students, received statements of educational objectives. The teachers attended a one-day seminar directed by the investigator, who also met once with the students to answer questions about the statements of objectives. The differences were not significant. Clingman suggested:

(1) Students' and teachers' unfamiliarity with performance objectives and levels-of-learning concept made the communication of objectives difficult at other than the recognition-recall level;

(2) the ability to understand and utilize objectives appeared to be acquired slowly;

(3) most of the students favored the idea of receiving objectives;

(4) most of the students in the treatment group reported that they were unable to use the objectives in a meaningful way.

Since the emphasis was not placed on the training of the teachers, it was difficult to ascertain the influence of training on the results reported in this study. Perhaps the training, per se, was inadequate. Additional findings reported by the investigator suggested a need for more specific training in the use of behavioral objectives for both

teachers and students.

In summary: the literature cited falls into one of two categories of research studies: (1) the investigations of the effects on learning when teachers possessed the objectives; (2) the investigations of the facilitative effect that the training of teachers in the use of performance objectives had on students' achievement. The first group of studies (N = 6) did not show significant effects on students' achievement as a function of teachers' possession of objectives. In the second group of studies (N = 4) two investigators (Piatt, 1969; Bryant, 1971) found that the training of teachers in the use of objectives had a facilitative effect on students' achievement. This facilitative effect was not found in the other two reported studies (Cardarelli, 1971; Clingman, 1972). Consequently, substantial support was not provided for the training of teachers in the use of behavioral objectives.

Although these ten studies used, in the main, better designs and data analyses than did the studies cited in the section preceding this one, all failed to define the independent variable performance objective adequately. Indeed, it would be impossible to replicate any one of them, given the definitions of performance objective published in these studies.

Form of Performance Objectives

Nearly all writers have asserted that there are three components of a performance objective: a verb which describes the learner performance or activity; a statement of the condition(s) under which this performance takes place; and a statement of the standard by which the performance is judged or evaluated. All writers agree that these three components must be stated in clear, unequivocal terms (Tyler, 1934; Mager, 1962;

Lindval, 1964; Bloom, 1964; Kibler, Barker, and Miles, 1970; Popham and Baker, 1970; Gerlach and Ely, 1971). Mager's criteria have become so widely accepted that they are worth reproducing here:

(1) One should state the objective in terms of what the learner will be able to do after the learning experience. This is done by selecting verbs which describe observable actions. Such words as identify, describe, construct, and list are far less ambiguous than verbs such as to know, understand, or appreciate.

(2) The second characteristic of a well-stated objective is a statement of the conditions under which the performance is to occur. Conditions should be stated clearly enough that others understand your intent as you understand it.

(3) The third characteristic of a well-stated objective is the criterion, the quality or level of performance that will be considered acceptable.

In the years that have passed since their original publication in 1962, these criteria have been subjected to minor criticism. Merrill (1971), for example, has charged that these criteria fail to provide for distinguishing between or among levels of behavior. Another objection raised by Merrill is that there are almost always two aspects of conditions under which behavior occurs. The first is concerned with those conditions related to a particular subject matter and unique to the testing situation. An example of a condition stated in a behavioral objective for a mathematics class would be "... using only a calculator..." or "... using only the protractor...' The second are the psychological conditions which help define the behavior being observed. In most cases

the psychological conditions are not stated in the objective, but have an important effect upon its meaning. This second type, quite often overlooked, is the more important of the two, since the type of behavior being observed will change when psychological conditions are changed. For example, the classroom learning environment is typically not normal the day before Christmas vacation begins.

The verb. The requirements for verbs have been expanded considerably by Gagné and Briggs (1979), who stated that two verbs must be present in every good performance objective. The first verb denotes action: writes, draws, selects, matches, names, groups, verifies; there are many others. The following example denotes action: "Without use of reference materials, state the provisions of the Fifth Amendment, in writing." While the action verb may be essential for effective communication, it is not necessarily the most important verb in an objective. The second verb (the major verb) denotes learned capability. It describes the to-be-learned human capability as it may be observed in some performance exhibited by the learner; discriminate, classify, demonstrate, generate, execute, originate, identify, and state are examples. A Gagné-Briggs performance objective, then, looks like these:

"identifies, by naming, the subject, direct object, and indirect object..."

"demonstrates, by solving orally presented examples, the addition of..."

"generates, by synthesizing applicable rules, a paragraph..."

The emphasis on the observability of the verb has led, quite naturally, to lists of recommended verbs. Some of the most highly recommended verbs

are "identify, name, describe, construct, state, discriminate, classify, generate, name, order, check, and perform." (Commission on Science Education, 1965; Gerlach, Sullivan, Baker, and Schutz, 1966; Briggs, 1970). Either explicitly or implicitly, such writers warn against the use of "vague" verbs such as know, understand, appreciate.

While the performance standard, either implied or expressed, is frequently 100% (minus some undesignated "measurement error"), it is not unusual to find a lower standard; for example, "80% of the class will achieve at least 80% accuracy," or "three out of five problems solved correctly," or "four out of six defects identified" (Bloom, 1971). Briggs (1970) stated that when the evaluation of the learner's performance is complex, it may be preferable to omit the standard in the performance objective and to present it in the test scoring key or in the grade conversion guide. Another quite different approach to stating the standard of performance is the mastery approach described by Gagné and Briggs (1979). They asserted that there are two compelling reasons for omitting the standard: (a) the standard is not likely to be applied in the same manrer to all individuals, and (b) the question of performance standard is a question of measurement and is integral to the problem of performance assessment. They contend that a concern for assessment procedure at the time when performance objectives are being generated will cause confusion. Rather, they assert, since learning is hierarchical in nature, and since the acquisition of a higher order behavior is contingent upon the mastery of all relevant lower order behaviors, it is unwise to adopt an arbitrary standard such as "five out of six correct responses." Mastery criteria vary from one objective

to another; they need to be determined as part of the assessment process.

Despite these differences, the form of the performance objective recommended by Mager in 1962 has almost become dogma in education and training. However, there are also those who have "left the church." Typical of their heretical statements is the assertion that there is no point in requiring that a performance objective be written in a standard form unless the purpose for writing the objective is considered first. There will be a wholesome variation in form between teacher-constructed objectives; the Mager model may help some writers while it may be totally unnecessary for others (Harlen, 1972).

Summary. The review of the literature leads to the following three conclusions:

(1) There is a general agreement, not supported by research, that performance objectives are useful for learners, instructors, and designers.

(2) Although there is a solid consensus regarding the definition of performance objective, the definition is not operational.

(3) While there is general agreement concerning the most desirable form of a performance objective, examples of objectives which possess the three formal characteristics may differ greatly from one another.

As a result of these findings, we decided to begin experimenting in an effort to develop a behavioral (or operational) definition of the term performance objective.

Study 1

Designer's manuals as well as research reports have focused almost entirely on the role of the verb in a performance objective. The statements of condition and criterion have been more or less taken for granted. This emphasis seems to have been based on the assumption that the verb is the primary, if not the sole, determiner of the degree to which an objective may be considered behavioral, since it is the verb that designates what the learner does. Lists of "observable" verbs began to appear. The implicit, if not explicit, guarantee was that when such verbs are used to construct objectives, the objectives will be "good," "worthwhile," "precise," "observable," and the like. Conversely, use of a verb not on a recommended list would automatically render an objective suspect (i.e., non-behavioral, to be avoided).

Deno and Jenkins (1969) appear to have been the first to provide evidence that the behavioral objectives cited in developmental curricula are not necessarily statements of highly observable behaviors. They attribute this inconsistency to the presumption that curriculum developers, both to avoid excessively lengthy documentation and to avoid the appearance of triviality, have moved to more general terms for which the referents are less directly observable. They asked 14 in-service educators to rate the observability of 99 verbs drawn from the objectives of a "widely cited" experimental curriculum on a scale from 1 (highly observable) to 5 (non-observable). (See Appendix A for instrument.) The results, in Table 1-1, show clearly that many commonly used verbs received intermediate ratings (around 3 on a 1 to 5 scale), and that almost half of the "action" verbs received ratings toward the nonobservable end of the scale (3 to 5). In itself, this finding

Table 1-1
Means and Variances of Ratings for 99 Verbs
(1 = highly observable, 5 = non-observable)

		Deno & Jenkins (1969)		Study 1	
	VERB	MEAN	VARIANCE	MEAN	VARIANCE
1.	To cover with a card	1.0	0.0	1.0	0.0
2.	To point to	1.0	0.0	1.1	0.1
3.	To line draw	1.0	0.0	1.1	0.2
4.	To mark	1.0	0.0	1.2	0.5
5.	To lever press	1.0	0.0	1.3	0.4
6.	To underline	1.0	0.3	1.0	0.0
7.	To cross out	1.1	0.3	1.1	0.1
8.	To walk	1.1	0.3	1.1	0.1
9.	To circle	1.2	0.3	1.0	0.0
10.	To repeat orally	1.2	0.3	1.2	0.3
11.	To count orally	1.2	0.7	1.1	0.3
12.	To say	1.2	0.7	1.4	0.4
13.	To write	1.3	0.4	1.0	0.0
14.	To put on	1.4	0.4	1.5	0.6
15.	To read orally	1.5	0.4	1.0	0.0
16.	To shade	1.5	0.8	1.6	0.6
17.	To number	1.5	0.4	1.1	0.1
18.	To name	1.5	0.8	1.4	0.7
19.	To fill in	1.6	0.9	1.4	0.5
20.	To label	1.7	1.1	1.3	0.4
21.	To state	1.7	1.4	1.4	1.0
22.	To remove	1.9	0.6	1.3	0.4
23.	To place	1.9	0.9	1.5	0.9
24.	To tell what	1.9	1.1	1.6	0.6
25.	To draw	2.0	0.9	1.1	0.3
26.	To identify in writing	2.1	1.4	1.3	0.5
27.	To check	2.2	1.2	1.9	1.2
28.	To construct	2.2	1.2	1.3	0.4
29.	To match	2.3	0.7	1.6	1.1
30.	To take away	2.3	1.1	1.4	0.5
31.	To make	2.4	0.9	1.3	0.3
32.	To arrange	2.5	0.6	1.7	0.8
33.	To finish	2.5	0.6	2.1	1.6
34.	To read	2.5	0.8	2.2	1.9
35.	To play	2.5	1.7	2.0	1.2
36.	To locate	2.6	0.6	1.5	0.7
37.	To connect	2.6	1.1	1.2	0.5
38.	To give	2.6	1.1	1.2	0.5
39.	To reject	2.7	1.1	2.0	1.1
40.	To select	2.7	1.4	1.7	1.1
41.	To choose	2.8	0.5	1.7	0.9
42.	To partition	2.9	0.4	1.6	1.3
43.	To change	2.9	0.9	2.8	1.8
44.	To use	2.9	1.1	2.4	1.4
45.	To subtract	2.9	1.3	1.5	0.9
46.	To perform	3.0	1.8	1.5	0.8
47.	To total	3.0	1.8	1.4	0.5
48.	To divide	3.0	0.8	1.5	0.7
49.	To order	3.0	0.9	1.6	1.2
50.	To measure	3.0	1.1	1.4	0.4

Table 1-1 (continued)

		Dana & Jenkins		Study 1	
		MEAN	VARIANCE	MEAN	VARIANCE
51.	To add	3.0	1.3	1.6	1.1
52.	To supply	3.0	1.3	1.9	0.6
53.	To demonstrate	3.1	0.8	1.9	0.9
54.	To regroup	3.1	1.0	2.0	1.1
55.	To multiply	3.1	1.2	1.5	0.9
56.	To round off	3.1	1.4	1.8	1.0
57.	To group	3.2	0.5	1.4	0.6
58.	To complete	3.2	0.9	1.9	1.3
59.	To respond to	3.3	0.6	2.3	1.8
60.	To average	3.3	1.1	1.9	1.5
61.	To summarize	3.3	1.1	2.5	1.7
62.	To inquire	3.5	0.8	2.6	1.9
63.	To utilize	3.5	1.0	2.9	2.0
64.	To borrow	3.5	0.4	1.9	0.9
65.	To acknowledge	3.5	1.1	3.1	1.5
66.	To find	3.6	1.6	1.9	1.3
67.	To identify	3.8	0.8	1.5	0.7
68.	To see	3.8	2.3	2.7	2.3
69.	To convert	3.9	1.3	2.3	1.7
70.	To distinguish	4.1	0.8	2.7	1.9
71.	To solve	4.2	0.9	2.3	1.9
72.	To apply	4.2	1.1	3.4	1.4
73.	To develop	4.3	0.4	3.6	1.2
74.	To test	4.3	0.4	2.3	1.9
75.	To determine	4.3	0.6	3.7	1.3
76.	To generate	4.3	0.7	3.6	1.7
77.	To create	4.3	1.1	2.6	2.0
78.	To discriminate	4.5	0.5	2.9	1.9
79.	To recognize	4.5	0.4	3.1	1.7
80.	To discover	4.7	0.2	3.2	1.5
81.	To become competent	4.7	0.3	3.9	1.4
82.	To infer	4.7	0.3	4.2	0.9
83.	To like	4.7	0.3	4.2	1.4
84.	To analyze	4.8	0.1	3.8	1.4
85.	To be curious	4.8	0.1	4.3	1.0
86.	To conclude	4.8	0.1	3.5	1.8
87.	To deduce	4.8	0.1	3.5	1.8
88.	To feel	4.8	0.1	4.3	1.3
89.	To concentrate	4.8	0.3	4.2	1.3
90.	To perceive	4.8	0.3	4.4	0.9
91.	To think	4.8	0.3	4.6	0.9
92.	To think critically	4.8	0.3	4.4	1.3
93.	To learn	4.8	0.3	4.1	1.3
94.	To appreciate	4.9	0.0	4.6	0.5
95.	To be aware	4.9	0.0	4.3	1.2
96.	To know	4.9	0.0	4.6	0.9
97.	To wonder	4.9	0.0	4.7	0.4
98.	To realize fully	5.0	0.0	4.6	0.7
99.	To understand	5.0	0.0	4.3	0.9

would hardly be worthy of mention. What is noteworthy is that many of the verbs that the advocates of behavioral objectives assert are open to few misinterpretations (e.g., deduce, determine, create, solve, round off, multiply) had mean ratings greater than 3.0 and the ratings of many of the verbs revealed surprisingly large variances (e.g., state, identify in writing, and round off each had variances of 1.4).

The conclusion drawn by Deno and Jenkins was that verbs used in behavioral objectives are chosen for consistency of usage rather than maximum observability per se, and that the terms "behavioral" and "observable," though related, are not synonyms. It is reasonable to suggest that other characteristics of words, such as clarity, precision, and concreteness are also at work in determining the choices of curriculum developers.

Because of the unexpected and striking nature of the Deno and Jenkins findings, we felt some pressure to verify their results; accordingly, we replicated their study. We were concerned with whether pre-service and in-service teachers in an education course would rate the verbs in a similar fashion. Subjects were 35 senior and first-year graduate students in an audiovisual education course at the University of Minnesota. We reproduced the original instrument, without change, and administered it during the fourth weekly meeting of the course.

The results, shown in Table 1-1, are essentially the same as those obtained by Deno and Jenkins. The correlation between the two sets of mean ratings was $r = .89$, while the correlation between the two sets of ratings, by rank, was $r' = .91$.

Obviously, the emphasis that advocates of behavioral objectives

have placed on "observable" or "unambiguous" verbs is open to question.

Study 2

Problem

The results of Study 1 led us to wonder whether or not the ratings would persist if we embedded the verbs in statements of objectives. Furthermore, since objectives generally consist of a statement of condition and a statement of criterion in addition to a verb, we wished to learn what role these two components would play in determining raters' perceptions of objectives. Consequently, we decided to seek answers to these two questions:

(1) Can we construct a set of objectives which will be rated high (i.e., 1.0 or close to 1.0) to low (i.e., 5.0 or close to 5.0) on the "most observable--least observable" scale and which will have low variances?

(2) If so, can we ascertain what characteristics account for the ratings which the objectives receive?

Procedures

Twenty-one senior and first-year graduate students enrolled in an audiovisual education course at the University of Minnesota completed a four-part questionnaire. Part I consisted of the 99 verbs rated in the Deno-Jenkins study (1969). Part II consisted of 17 expressions usable as statements of conditions in objectives (e.g., "given previously unencountered examples"). Part III consisted of 19 expressions usable as statements of criterion (e.g., "with 90% accuracy"). Part IV consisted

of 53 expressions divided into four types:

Type 1: Six "verb-only" statements.

Type 2: 12 statements containing a verb and a statement of conditions.

Type 3: 12 statements containing a verb and a statement of criterion.

Type 4: 23 complete behavioral objectives (verb plus condition plus criterion).

The items in Parts II and III were generated by the investigators, who subjectively selected expressions which they considered either "precise" or "vague." The items in Part IV, Types 2, 3, and 4, were generated by combining a verb from Part I with a condition statement from Part II and/or a criterion statement from Part III. The subjects were instructed to rate each item in Parts I and IV on a "most observable-least observable" scale from 1 to 5, respectively. The items in Parts II and III were to be rated on a similar five-point scale from "most precise" (1) to "most vague" (5).

Means and variances were computed for each item on the questionnaire. Correlations were then computed between and among the components and the total statements.

Results

Table 2-1 shows the means and variances for each item in Parts I, II, III, and IV respectively.

A multiple correlation of .83 was obtained between the mean ratings of the complete statements and the three components of each statement. Intercorrelations of mean ratings for the complete statements and each of their components are given in Table 2-2. These correlations are based

Table 2-1
Means and Variances of Ratings Obtained in Study 2

Part I	Verb	Mean	Variance
1.	To cover with a card	1.0	0.0
2.	To point to	1.1	0.1
3.	To line draw	1.1	0.2
4.	To mark	1.2	0.5
5.	To lever press	1.3	0.4
6.	To underline	1.0	0.0
7.	To cross out	1.1	0.1
8.	To walk	1.1	0.1
9.	To circle	1.0	0.0
10.	To repeat orally	1.2	0.3
11.	To count orally	1.1	0.3
12.	To say	1.4	0.4
13.	To write	1.0	0.0
14.	To put on	1.5	0.6
15.	To read orally	1.0	0.0
16.	To shade	1.6	0.6
17.	To number	1.1	0.1
18.	To name	1.4	0.7
19.	To fill in	1.4	0.5
20.	To label	1.3	0.4
21.	To state	1.4	1.0
22.	To remove	1.3	0.4
23.	To place	1.5	0.9
24.	To tell what	1.6	0.6
25.	To draw	1.1	0.3
26.	To identify in writing	1.3	0.5
27.	To check	1.9	1.2
28.	To construct	1.3	0.4
29.	To match	1.6	1.1
30.	To take away	1.4	0.5
31.	To make	1.3	0.3
32.	To arrange	1.7	0.8
33.	To finish	2.1	1.5
34.	To read	2.2	1.9
35.	To play	2.0	1.2
36.	To locate	1.5	0.7
37.	To connect	1.2	0.5
38.	To give	1.2	0.5
39.	To reject	2.0	1.1
40.	To select	1.7	1.1
41.	To choose	1.7	0.9
42.	To partition	1.6	1.3
43.	To change	2.6	1.8
44.	To use	2.4	1.4
45.	To subtract	1.5	0.9
46.	To perform	1.5	0.8
47.	To total	1.4	0.5
48.	To divide	1.5	0.7

Table 2-1 (continued)

	Verb	Mean	Variance
49.	To order	1.6	1.2
50.	To measure	1.4	0.4
51.	To add	1.6	1.1
52.	To supply	1.9	0.6
53.	To demonstrate	1.9	0.9
54.	To regroup	2.0	1.1
55.	To multiply	1.5	0.9
56.	To round off	1.8	1.0
57.	To group	1.4	0.6
58.	To complete	1.9	1.3
59.	To respond to	2.3	1.8
60.	To average	1.9	1.5
61.	To summarize	2.5	1.7
62.	To inquire	2.6	1.9
63.	To utilize	2.9	2.0
64.	To borrow	1.9	0.9
65.	To acknowledge	3.1	1.5
66.	To find	1.9	1.3
67.	To identify	1.5	0.7
68.	To see	2.7	2.3
69.	To convert	2.3	1.7
70.	To distinguish	2.7	1.9
71.	To solve	2.5	1.9
72.	To apply	3.4	1.4
73.	To develop	3.6	1.2
74.	To test	2.5	1.9
75.	To determine	3.7	1.5
76.	To generate	3.6	1.7
77.	To create	3.6	2.0
78.	To discriminate	2.9	1.9
79.	To recognize	3.1	1.7
80.	To discover	3.2	1.5
81.	To become competent	3.9	1.4
82.	To infer	4.2	0.9
83.	To like	4.2	1.4
84.	To analyze	3.8	1.4
85.	To be curious	4.3	1.0
86.	To conclude	3.3	2.2
87.	To deduce	3.5	1.8
88.	To feel	4.3	1.5
89.	To concentrate	4.2	1.3
90.	To perceive	4.4	0.9
91.	To think	4.6	0.9
92.	To think critically	4.4	1.3
93.	To learn	4.1	1.3
94.	To appreciate	4.6	0.5
95.	To be aware	4.3	1.2
96.	To know	4.6	0.9
97.	To wonder	4.7	0.4
98.	To realize fully	4.6	0.7
99.	To understand	4.5	0.9

Table 2-1 (continued)

Part IV	Objective Statement	Mean	Variance
1.	To cover x & y with a card	1.0	0.0
2.	To remove x & y with no more than one error given pliers, screwdriver and hammer	1.1	0.1
3.	To write x & y from memory	1.1	0.1
4.	To lever press either x or y within two seconds	1.1	0.1
5.	To point to x & y with 100% accuracy	1.1	0.2
6.	To count orally to x & y	1.2	0.3
7.	To play x & y with 100% accuracy from memory	1.2	0.7
8.	To determine x & y with no more than one error, given a tape measure, a 3' chain and a compass	1.3	0.8
9.	To supply x & y, given specific tools or equipment	1.4	0.4
10.	To read x & y without error	1.5	1.7
11.	To convert x & y on the first attempt, given a correctly solved example for reference	1.5	0.7
12.	To draw x & y without any reference to help	1.6	0.8
13.	To round off x & t on the first attempt	1.8	0.8
14.	To demonstrate x & y, given exemplars and non-exemplars of correct demonstrations	1.8	1.2
15.	To line draw x & y consistently, given previously unencountered tasks	1.8	1.5
16.	To label x & y without error, given visible encouragement	1.9	1.5
17.	To check x & y	2.0	2.0
18.	To circle x & y appropriately, given adequate opportunity	2.0	1.9
19.	To number x & y given audible encouragement	2.1	1.3
20.	To find x & y always	2.1	1.9
21.	To regroup x & y, given audible encouragement	2.2	1.7
22.	To cross out x & y at least three out of four times, given pleasing examples	2.5	2.0
23.	To mark x & y satisfactorily	2.5	2.0
24.	To learn x y with 90% accuracy	2.6	2.5
25.	To respond to x & y with no more than two errors, given various chances	2.7	1.5
26.	To reject x & y	2.7	2.8
27.	To arrange x & y, given highly motivating conditions	2.8	1.5
28.	To borrow from x & y consistently, given previously unencountered examples	2.8	1.3
29.	To underline x & y, given examples that are aesthetically satisfying	3.0	2.3
30.	To average x & y understandingly, given adequate opportunity	3.1	1.7
31.	To connect x & y with awareness, given a correctly solved example for reference	3.1	2.1
32.	To analyze x & y on the first attempt, given carious chances	3.2	1.5

Table 2-1 (continued)

33.	To read x & y orally with understanding	3.2	1.9
34.	To become competent in x & y within three days	3.3	2.1
35.	To repeat x & y orally with feeling, given highly stimulating motivation	3.4	1.6
36.	To choose x & y aesthetically, given certain tools	3.5	1.5
37.	To select x & y satisfactorily	3.6	1.1
38.	To complete x & y knowingly	.6	1.5
39.	To finish x & y with awareness, without reference to any helps	3.6	2.0
40.	To infer x & y knowingly, given five statements of fact and five statements of opinion	3.7	1.1
41.	To know x & y satisfactorily	3.9	1.3
42.	To realize x & y fully, given some opportunity	4.0	1.4
43.	To perceive x & y	4.0	1.8
44.	To think about x & y critically at least three out of four times given some motivation	4.1	2.1
45.	To think about x & y with 100% accuracy, given a choice of doing so or not	4.3	0.8
46.	To feel about x & y without reference to any aids	4.3	1.3
47.	To understand x & y	4.4	1.3
48.	To concentrate on x & y, given no more than an average opportunity	4.4	1.3
49.	To wonder about x & y, given previously unencountered examples	4.5	0.6
50.	To be curious about x & y always	4.5	0.5
51.	To genuinely appreciate x & y, given a choice of doing so or not	4.5	0.7
52.	To be appropriately aware of x & t, given traditional encouragement	4.6	0.4
53.	To like x & y genuinely, given generally satisfactory motivation	4.7	0.2

Table 2-2

Intercorrelations of Mean Ratings Obtained in Study 2

	Condition	Criterion	Verb
Complete Statement	.26 (n = 24)	.44 (n = 22)	.78 (n = 38)

on statements having components identical to those used in the first three parts of the questionnaire. Table 2-3 gives the correlations between and among the mean ratings of the components as they appeared in Part IV.

Discussion

Although the study supports the assumption that verbs are crucial in statements of behavioral objectives, the results also indicate that there is more to constructing an objective than merely selecting a "good" verb. The correlations between the complete statements and the components indicate that the choice of criterion statements may also be important. The correlation between the condition and criterion may be partly explained by the combinations used in the questionnaire. Since the selection of components was not random, i.e., the resulting statements had to make sense, some bias might have been introduced into the study.

Although two different rating scales, observability and precision, were used in the questionnaire, it was assumed that each was measuring the same characteristic of the statement and that the ratings, therefore, could be compared. Obviously, further studies were needed to justify this assumption.

The results of Study 2 indicate that when statements of conditions or statements of criteria or both are added to verbs of known "observability," respondents' perceptions may be altered.

Table 2-3

Correlations between Ratings of Components -- Study 2

	Condition	Criterion	Verb
1. Condition	--	--	--
2. Criterion	.19	--	--
3. Verb	.05	-.03	--
4. Complete Statement	.16	.49	.78
	1	2	3

Study 3

Since we had obtained evidence to the effect that condition and criterion affect raters' perceptions of the observability of an objective, we were naturally curious as to whether or not the assumption that the verb is the most important component of an objective can be supported. Consequently, we designed a study to determine the ratings of typical verbs, conditions, and criteria used in behavioral objectives, as well as ratings of complete statements of objectives. Additionally, the role which each type of component plays in a complete objective was observed. Finally, the study was designed to explore the effects of the dimension used to rate the various expressions.

Method

Materials. Twenty-five objectives were created by combining, on a quasi-random basis, the required number of verbs, conditions, and criteria. Some statements were rearranged to avoid combinations that seemed either meaningless or frivolous to the research team (e.g., "to like..., given appropriate tools"). The components were selected to cover the entire range of ratings (1.0 to 5.0) obtained in previous work (Deno and Jenkins, 1969; Studies 1 and 2, above). The rating booklets were prepared by randomly listing the 25 items of each type (verbs, conditions, criteria, objectives) on a single page and counterbalancing the order of the pages to control for order effects. Each item appeared once in its component list and once in the list of objectives. The four pages of lists, containing the 100 items to be rated, plus a cover page giving instructions, five sample ratings, and the rating dimension to be used, constituted the experimental booklet. The four rating dimensions and four page orders

generated sixteen different booklets.

The four rating scales used in this study were most observable - least observable, precise - vague, clear - ambiguous, and concrete - abstract. Each subject rated items on only one of these scales. This scale was presented on each page of the booklet, along with a diagram on which the extremes were labeled A and E. Subjects recorded their ratings on IBM scoring sheets.

Subjects and Procedure. Eighty students in an Arizona State University upper-division education class participated in this study as part of a regular class session The booklets were interleaved in such a manner that every sixteenth subject received the same booklet. The subjects were given oral and written instructions explaining the method of rating and the use of the scoring sheet

Data Analysis. This study was designed to ascertain the correlations between the three separate components of behavioral objectives and the complete objective in which they are embedded. The basic data consists of the means and variances of the subjects' ratings of each of the 100 items in the booklet. All bivariate coefficients reported in this report are Pearson product - moment correlation coefficients.

Analysis was done by computer, using appropriate SPSS programs, after data were transferred from the IBM answer sheets to punched cards.

Results

When the mean ratings for the objectives are compared with those of the components, it becomes apparent that the verb's effect on the rating is not as great as had been assumed. Table 3-1 gives the means and variances for four of the 25 objectives and components. These ratings

Table 3-1
Means and Variances of Ratings for Selected Objectives and Components by Characteristic -- Study 3

	Observability		Precision		Clarity		Concreteness	
	$\bar{X}$	σ^2	$\bar{X}$	σ^2	$\bar{X}$	σ^2	$\bar{X}$	σ^2
Objective #11	1.5	.7	1.8	1.4	1.4	.8	1.6	1.6
To measure	1.8	1.0	1.6	.8	1.6	1.0	1.3	.4
to the nearest quarter inch	2.0	1.4	1.8	1.5	1.4	.9	1.4	.6
given a ruler	2.0	1.7	2.0	2.4	1.4	1.2	1.8	1.9
Objective #18	3.3	1.0	3.7	1.2	3.1	1.3	3.6	1.7
To infer	3.4	1.9	3.6	1.9	3.4	1.5	4.0	1.5
given previous unencountered	3.4	1.4	3.4	1.9	2.8	2.3	3.2	2.8
examples	3.0	1.3	3.3	2.2	3.0	1.5	2.7	2.2
Objective #13	2.3	2.0	2.0	1.8	2.2	2.4	2.2	1.7
To know	3.0	2.0	3.7	2.3	3.6	1.1	3.3	3.4
in the same order as that given in the textbook	1.8	1.3	1.9	1.4	1.6	.8	1.9	1.1
given an unordered list of items	2.6	2.3	2.8	2.9	2.2	1.6	2.0	1.1
Objective #2	3.2	1.5	3.8	1.2	2.8	1.9	3.1	2.0
To read	1.7	.7	1.8	1.4	1.9	1.4	1.8	.9
with feeling	2.7	1.9	4.2	1.6	2.2	.8	3.9	1.1
given a passage not encountered in the previous week	3.1	2.0	3.6	2.2	2.2	1.8	2.6	1.4

are fairly consistent across the four rating scales. In the first two objectives, #11 and #18, little difference is found when the mean rating for the objective is compared with the verb rating. However, when similar comparisons are made for the last objectives, #15 and #2, distinct differences are observed. In these latter cases, the ratings for the conditions and criteria are different from those of the verbs and the ratings for the objectives tend to agree more with those obtained for the conditions and criteria.

The correlations between mean ratings of individual components and objectives are shown in Table 3-2. In each case, the correlation is based on 25 pairs of scores -- 25 component means and 25 objectives. The pattern of intercorrelations is generally the same for each rating scale, and the relative homogeneity of the coefficients suggests that each component makes nearly the same contribution to the rating of the objective.

Positive correlations were also found between the mean ratings of conditions and criteria. These correlations ranged from +.14 to +.36 and do not overlap with those reported in Table 3-2, indicating that we are dealing with very discrete and different phenomena.

Discussion

The results of this study clearly indicate that conditions and criteria contribute to individuals' perceptions of objectives. This is in marked contrast to findings of earlier studies, where the emphasis was on the verb. The present study provides strong indication that variables other than the observability of the verb must be considered when objectives are constructed. Instructional designers, researchers, and evaluators must also be concerned with the choice of conditions and criteria.

Table 3-2
Correlations between Ratings of Components
and Complete Objectives -- Study 3

Rating Scale	Verb	Condition	Criterion
Observability	.43	.60	.58
Precision	.39	.59	.71
Clarity	.42	.62	.53
Concreteness	.56	.52	.53

Since it is often meaningless to consider the observability of conditions and criteria in isolation (e.g., "given the occasion," or "confidently"), the similarity of ratings for the four scales-- observability, precision, clarity, and concreteness-- indicate that these characteristics could be used interchangeably. If an objective is to be used to guide a student's study, it may be more informative to talk about its precision or clarity than about its observability. In such cases, the instructional designer wants to be certain the student knows what is important in the material. This is in contrast to the teacher's desire to know how the student will respond when he has mastered the material. It is in the latter case that an observable behavior becomes important.

The quasi-random procedure used to assemble the objectives may have resulted in a "built-in" correlation between the conditions and criteria in some objectives. The investigators edited the list in an effort to make sensible objectives. Nonsensical combinations, such as "To construct x genuinely, given a passage not encountered during the past week" were either edited or replaced. This probably introduced a bias against objectives in which very vague criteria were coupled with very precise conditions or in which very precise criteria were coupled with very vague conditions. However, as far as method is concerned, this was probably the best way to proceed in order to avoid meaningless objectives and to simulate the realistic use of objectives within an instructional milieu.

One other factor may have influenced the ratings obtained in this study. In the list of objectives, "x" and "y" were inserted for the direct objects to avoid the use of specific subject matter in the study. The respondents' "mental" choice of a replacement for these components may also have influenced their ratings.

Study 4

Our next effort in developing an operational definition of the concept "performance objective" stems directly from Study 3. There we found that a substantial portion of the variance of ratings of total objectives could be accounted for by a linear combination of the three component parts, verb, condition, and criterion. The variance unaccounted for was a nagging concern, however, and led to a reanalysis of the problem. In the reanalysis, it became clear that the role of the direct object was being ignored. In all studies up to this point, "x" and "y" had been inserted where the direct object would normally be found, e.g., "to draw x accurately from memory." This was done to avoid interference from choice of specific subject matter; in many practical cases, the direct object constitutes a "given" that is ordinarily not subject to variation by the instructional designer. To the degree that subjects mentally inserted their own choice of direct object, the overall rating may have been affected. For example, a subject who thinks in terms of fairly concrete objects such as "a square" might rate the overall objective as much more precise and observable than one who mentally inserts the word "something." Furthermore, it seemed possible that the use of the unspecified, abstract letters as direct objects might have caused a general shift toward perception of objectives as less observable or less precise. For these reasons, it seemed desirable to determine the strength of association between the choice of direct object and the overall rating of the complete objective.

The fourth study was designed to explore the role of the direct object in the perception of the complete behavioral objective. The study was designed to answer the following specific questions:

(1) Does the inclusion of direct objects, as opposed to abstract direct objects (i.e., "x" or "y"), in statements of behavioral objectives generate an overall shift of ratings in the direction of increased observability and precision?

(2) Do the ratings of individual objectives change as a result of the choice of different direct objects?

Since it could be argued that a positive answer to the second question would cloud the interpretation of a positive answer to the first, the lists used were balanced by selecting direct objects that covered a wide range of observability. In this way, it was hoped to avoid the objection that any overall shift was caused by using highly observable direct objects throughout.

Method

Subjects and design. Sixty-four undergraduate students from two Arizona State University upper division instructional media courses participated in this study as part of their regular class sessions. Four additional students omitted items from their response booklets, rendering these booklets useless; their data were excluded from the study.

Responses of 44 of these subjects were used in the main design of the study. Each of these subjects rated 24 objective statements containing 24 different direct objects. Each subject also rated the 24 direct objects in isolation for purposes of comparison. The 24 objects were organized into six objective sets of four objectives each. Within each set, the verb, condition, and criterion were identical, so that the four objectives varied only in choice of direct object. Different sets used different verbs, conditions, and criteria, and no component of an objective was used in two different objective sets. The arrangement of components is shown in Table 4-1, from which the entire set of 24 objectives can be reconstructed.

Table 4-1

Components of the Six Objective Sets - Study 4

Verb	Condition	Criterion	Direct Object
1. To draw	from memory	accurately	simple floor plans... conclusions... a graph... organizational charts...
2. To identify	given various chances	appropriately	pictures of instruments... factors influencing... stated and unstated assumptions... cause and effect relationships...
3. To use	given the choice of doing so or not	frequently	syllabication... percent to solve... school and public libraries... a desk calculator...
4. To recognize	given no help	on the first attempt	errors in logic... interrelationships... the tentativeness of conclusions... evasiveness...
5. To know	given five attempts	with 30 minutes	scientific terms... law of operation... the political structure... the function of officers...
6. To understand	given audible encouragement	without error	computer processes... nature of a scientific... costs of education... idiomatic expressions...

The experimental design was a repeated measures nested design, with six objective sets and (four different) direct objects nested within objective sets. This design was replicated with two rating dimensions, observability and precision; 22 subjects were used for each rating dimension. The ratings of direct objects in isolation were collected for the purpose of determining the correlation between direct objects and complete objectives containing those direct objects.

In addition to the main design, 20 additional subjects rated six complete objectives containing "x" or "y" in place of the direct object. These six objectives corresponded to the six objective sets used in the main design. These ratings were collected to compare overall ratings with and without explicit direct objects. Again, half the subjects rated observability and half precision.

Materials and Procedure

Subjects in the main design each received a booklet containing four pages of complete objectives, six to a page. On each page, one objective from each objective set appeared. A fifth page contained the 24 direct objects to be rated in isolation. The rating scale to be used was printed at the top of each page in the booklet, in a diagram depicting the full range of the scale, most observable (1) to least observable (5) or precise (1) to vague (5). The same rating dimension was used throughout each booklet. Subjects recorded their responses directly in the booklets. The booklets were assembled in counterbalanced order, to avoid order effects, and were stapled to a cover page which provided instructions and two

sample ratings.*

For the 20 subjects rating objectives without direct objects, the six objectives to be rated were all on a single page; the same cover sheet was used for these booklets.

The 24 direct objects used in this study were selected from objectives developed by the National Assessment Project (1972). The pool of direct objects was rated a priori by the experimenters for observability and precision; the final 24 selected provided a wide range of values within each objective set. The six verbs used (cf. Table 4-1) were selected from a pool of verbs that are not domain specific, and for which earlier studies had provided data concerning the perceived observability, both in isolation and in context. They were chosen so that the mean ratings covered the entire spectrum of the observability scale. The conditions and criteria were chosen in similar fashion. The components were combined into objectives in such a way as to avoid absurdities, and to be consistent with generally accepted grammatical and contextual conventions.

The subjects were given oral and written instructions by the experimenter at the outset, along with the examples explaining the method of rating. Specific reference was made in the instructions to the fact that these statements are typical of expressions used in instructional objectives. The subjects were also instructed not to refer back to a page once it had been completed.

---

*All subjects also rated 25 verbs, 25 conditions, and 25 criteria as part of a replication of previous work. The results from these ratings generally confirm previous results, and they will not be discussed further in this report.

Results

The means and standard deviations for objective sets, with and without direct objects, are shown in Table 4-2 separately for each rating dimension. It is readily apparent that there is no significant difference between subjects' ratings of objectives with direct objects and objectives containing "x" and "y." This is reflected in tests computed separately for observability, t (30) = 0.60, and precision, t (30) = 1.18.

Turning to the question of differences induced by choice of direct object, an analysis of variance was computed separately for each of the two rating dimensions; this was done for purposes of both simplicity and clarity. The results of the two analyses are shown in Tables 4-3 and 4-4. As expected, since an effort had been made to construct objective sets differing in ratings, the mean ratings for verb sets differed significantly; in the observability analysis, the most observable objective was "to accurately draw a graph from memory" and the least observable objective was "to understand computer processes without error, given audible encouragement"; in the precision analysis, the most precise objective was "to draw simple floor plans of furnishings in rooms, from memory" and the least precise was "to appropriately identify stated and unstated assumptions, given various chances." More important was the question of whether the direct objects caused significant differences within objective sets, that is, whether the four objectives within objective sets differed. The results are clear for both rating dimensions. The objectives within sets differ significantly more than would be expected by chance; for observability, F (18,378) = 2.41, $p < .01$; for precision, F (18,378) = 2.27, $p < .01$. This finding is further bolstered by the

Table 4-2

Means and Standard Deviations of Ratings for Objective Sets -- Study 4

	Observability			Precision		
	$\bar{X}$	S	N	$\bar{X}$	S	N
Objectives containing x and y in place of direct objects	3.012	.4754	10	3.046	.6164	10
Objectives with direct objects	2.890	.5385	22	2.760	.6132	22

Table 4-3

Analysis of Variance Summary Table for Observability -- Study 4

Source	SS	df	MS	F
Subjects	145.9773	21	6.951	
Verb Sets	119.197	5	23.839	10.502*
Direct Objects within Verb Sets	40.8636	18	2.270	2.4059*
Subjects by Verb Sets	303.3863	105	2.8894	
Residual	356.6364	378	.9435	
TOTAL	966.0606			

*p < .01

Table 4-4

Analysis of Variance Summary Table for Precision -- Study 4

Source	SS	df	MS	F
Subjects	189.3106	21	9.0148	
Verb Sets	47.3333	5	9.4666	5.28*
Direct Objects within Verb Sets	32.2955	18	1.7942	2.27*
Subjects by Verb Sets	261.6667	105	2.4921	
Residual	299.2045	378	.7915	
TOTAL	829.8106			

*p < .01

correlations between ratings of direct objects and ratings of objectives containing those direct objects, computed within sets and averaged: +.78 for observability ratings and +.41 for precision (p's < .05).

Discussion

The results indicate clearly that the choice of direct object does influence raters' perceptions of the observability and precision of a behavioral objective. Taken together with the results of Study 3, these results provide convincing evidence that no single component, such as the verb, should be singled out as being of primary importance in determining the character of a behavioral objective. Rather, careful attention must be paid to all components to insure an objective that is observable, precise, clear, and concrete. This conclusion must be tempered by the realization that the instructional designer does not have complete freedom in selecting direct objects. Instead, they are often specified by the user organization as part of the instructional goal. For example, if the aim is to teach the student to multiply fractions, there is little opportunity to substitute another direct object. However, once alerted to the problem, the instructional designer will have no difficulty, having recognized the inherent imprecision of asking the child to "draw a nice picture," in seeking a more precise, observable direct object.

The absence of a pronounced shift toward greater observability and precision for objectives containing direct objects suggests that subjects either (1) substitute mentally their own direct objects, which average out to about the same values as real direct objects, and/or (2) ignore the "x" as an active element in the objective when they have not been exposed to other sentences containing real direct objects. Regardless of the

interpretation, the lack of a radical shift lends increased confidence to results obtained in previous studies employing only "x" and "y" in objectives.

The empirical data gathered in this study on the ratings of the components of a behavioral objective in isolation and within complete statements of objectives indicate that the selection of the various components influences individuals' perceptions of objectives. The data suggest that we are moving closer to a consistent operational definition of the behavioral objective. As the function of the individual components becomes more clearly delineated, educators and trainers should be able to select and to construct more precise statements of performance objectives.

Study 5

Thus far our studies have led us to conclude that emphasis on any one component of a performance objective is unwarranted. This finding is inconsistent with the injunctions and exhortations found in most, if not all, manuals and guidelines for instructional systems design. Our studies clearly indicate that empirical evidence is needed to determine how an objective should be constructed in order to maximize the possibility that the reader will perceive it as describing an observable event.

However, all the studies cited above used educators or students in colleges of education as subjects. Generalizing the findings to other populations would be warranted only if a high relationship could be found between the results of the studies cited and the results of a replication using another population. Specifically, it was hypothesized that the findings could be generalized to two types of military personnel: trainees and trainers (including instructional systems designers).

To gather preliminary data for testing this hypothesis, replications of Study 1 were conducted on two target populations. We felt this step was required because no other historical data were available which could be used as a basis for comparison with the Deno-Jenkins results.

The first replication used 30 undergraduate pilot trainees at Williams AFB, Arizona. They were administered an instrument containing 123 verbs which each trainee was asked to rate on a quintile scale from most observable to least observable. This instrument was exactly the same as that used by Deno and Jenkins (1969), with one addition: the previous instrument contained 99 verbs found in school curricula; the present instrument contained all these plus 24 verbs found in USAF Undergraduate Pilot Training syllabi. A second replication, using the same instrument, was conducted at Luke AFB, Arizona, where 17 members of four Instructional Systems Development teams served as subjects.

Results

The correlations between the ratings of the pilot trainees and the results reported by Deno and Jenkins was .90. The correlation between the ratings of the ISD team members and the Deno-Jenkins results was .91. The correlation between the trainee and ISD ratings was .89.

The mean rating of the 99 verbs used by Deno and Jenkins was 3.06. Pilot trainees gave these same verbs a mean rating of 2.57, while ISD team members rated them 2.51. The 24 verbs which were selected from ATC training materials were given mean ratings of 2.46 and 2.50 by the UPTs and ISD team members, respectively.

Conclusions

The correlations obtained are sufficiently high to warrant our concluding that, with respect to the content of this study, we are dealing with highly similar if not identical populations. Consequently, we tentatively inferred that the findings of earlier studies concerning the three components of performance objectives, as well as the findings concerning direct objects, are generalizable to the context of Air Force training.

It appears that some of the operational difficulties currently encountered by field ISD teams (especially for complex perceptual-motor skill training) would be reduced if existing manuals were revised and new manuals written to incorporate the findings concerning the observability of verbs. Furthermore, the three factor model of objectives (verb, conditions, and criteria) should be expanded to include the direct object.

Study 6

Having established a precise form from which objectives should be drawn in the above five studies, the final study was conducted to examine how well they would function in the classroom. In the earlier reported research, little support was found for the training of teachers in the use of behavioral objectives. In addition, the effectiveness of teacher training was measured by subsequent student performance rather than the resulting behavior of the teacher. To overcome this obvious methodological flaw, a technique was developed whereby the instructor's performance in the use of objectives was independently evaluated by a trained observer. Thus, a sixth study was conducted to assess -- through experimental isolation of the instructor training variable -- both the effects of training in the use of behavioral objectives on teacher behavior and student achievement.

Method

Prior to the experiment, 19 graduate teaching assistants were administered a pretest that assessed their a priori knowledge level on the use of behavioral objectives. After subjects' stratification by high and low a priori knowledge level, they were randomly assigned to either a training or no-training treatment condition. The subjects assigned to the training condition received instruction on the use of behavioral objectives and a posttest assessing their cognitive performance in acquiring the teaching skills. All subjects then received the instructors' materials and directions for teaching a short unit of instruction. Subjects were assigned to an instructional setting and informed that they should present the short unit of instruction. Prior to the instructional sessions, 10 observers were trained to rate on an observation form the quality of the instructor's behavior (i.e., the degree of use of the behavioral objectives of the unit) on a scale ranging from vague (1) to precise (5). After each instructional session, a post-teaching pupil assessment was administered.

Design. The basic design was a posttest-only 2 x 2 factorial design with Student Achievement as the dependent variable and the variables Training level and A priori knowledge level as the independent variables.

Subjects. Subjects were 19 volunteer graduate teaching assistants, who served as instructors, and 170 undergraduate student volunteers from Arizona State University who received the instruction and completed the posttest. Students were randomly assigned to instructional groups.

Materials. The pretest administered to the instructors to assess their a priori knowledge level on the use of objectives consisted of items that required the subject to distinguish between objectives and activities, to identify worthwhile objectives, and to identify well-written objectives. The instructors' training consisted of the following: a

self-instructional booklet on objectives developed for and tested in the Competency-Based Instruction course in the Department of Educational Technology at Arizona State University; practice exercises and feedback for each objective covered in the booklet (to distinguish between activities and behavioral objectives, to identify well-written objectives); and a 30-item examination over the objectives. The instructors' material -- an 11 page handout -- consisted of a short unit on the innovation decision-making process model. The material included: (a) a general introduction, (b) four behavioral objectives, (c) a discussion of the four stages of the model, (d) a graphic model of the four stages, and (e) an applied example of each of the four stages of the model. Ten graduate assistants were trained to serve as classroom observers and to rate the instructors' performances. They were given the following materials: an abbreviated form of the instructors' material, consisting of the (a) general introduction, (b) the four behavioral objectives, (c) a graphic model of the four stages, and (d) an applied example of each of the four stages of the model. Each student received an objective posttest that consisted of 10 multiple choice and short answer items matched to the four objectives of the instructional unit.

The observers were given an observation form containing 12 statements about the vagueness and preciseness of the instructors' behavior (i.e., the use of the behavioral objectives of the instructional unit).

Instructors' training. Results of a pretest on the use of behavioral objectives were used to stratify subjects according to high and low a priori knowledge levels. Subjects were then randomly assigned to one of two experimental conditions. The 10 subjects assigned to the training condition

completed a self-instructional booklet on the use of behavioral objectives, practice exercises, and a 30 item posttest. Then these subjects were given the instructors' materials and the following instructions: Instructions will be delivered in a classroom setting; use visual aids, handouts, or any other instructional material during the instructional sessions; do not exceed 30 minutes; students will be given a short examination on the instructional unit. The instructors were not informed of the observers and the ratings on the observation forms prior to instruction. The nine subjects assigned to the no-training group condition received the same instructors' material and instructions as the subjects in the training condition. For both conditions, each subject was informed when and where to meet for a 30 minute instructional session.

Observers' training. After receiving the abbreviated form of the instructional materials, the observers were asked to familiarize themselves with the content of the instructional unit to be presented. After the instructional session, the observers rated on an observation form the instructor's behavior on a scale ranging from vague (1) to precise (5). All responses on the observation form were summed to yield a total score per observer; this constituted the operationalization of the Observation variable.

Experimental session. Prior to each instructional session, students were asked by the experimenter for their attention and participation for the presentation by the instructor. The students were informed that they would be asked to answer questions on an examination form about the instructional material. Following the instructional section, students completed a short examination and were dismissed.

Results

Posttests were scored for number correct. An analysis of variance revealed no significant differences on student achievement (Table 6). However, data generated by the observer ratings yielded several significant and important effects. The mean amount of Students' Achievement correlated positively with the Observations by the observers for the Training and No Training conditions. The corresponding r for the Training condition was .54, $p < .001$. After the Observation scores for both conditions were divided into High and Low Observation scores through the n-split technique, it was found that in the Training and No Training conditions a consistently high, positive correlation was found between the mean Students' Achievement scores for each subject (i.e. instructor) and the total Observation score for each subject: for the High Training group $r = .87$, $p < .01$, for the Low Training group $r = .73$, $p < .05$; for the High No Training group $r = .77$, $p < .05$; for the Low No Training group $r = .84$, $p < .05$.

Finally, all Observation scores were grouped into High and Low scores through the n-split technique. These groupings were correlated with the corresponding means of the Students' Achievement scores, regardless of the Training or No Training conditions. For the High Observation group $r = .62$, $p < .05$; for the Low Observation group $r = .75$, $p < .01$. These correlations indicate that the observations and the corresponding students' achievement have a high degree of statistical association

Conclusions

The hypothesis, students instructed by teachers trained in the use of behavioral objectives would achieve higher scores on an examination than

Table 6-1
Anova Table for Study 6

Source	SS	DF	MS	F
A Treatments (between training & no training groups)	3.512	1	3.512	.53
B a priori knowledge (between all Highs & Lows)	7.902	1	7.902	1.20
Interaction (A X B)	17.780	1	17.780	2.70
Error	1053.854	160	6.587	

students instructed by untrained teachers, was not supported in this study. The results, the lack of significant differences between the Training and No Training conditions, support the earlier findings of Cardarelli (1971) and Clingman (1972), who failed to find a facilitative effect of the training of teachers in the use of behavioral objectives as reflected by students' achievement. The results of the within group analyses, i.e., the variances within the Training and No Training conditions, suggest that a priori knowledge of the use of behavioral objectives does not have an effect on students' achievement.

Although significant differences were not yielded by this study, the experimental isolation of the Training variable and the use of the classroom observers and their resulting observation scores for each subject provided a new dimension to the research on the facilitative effects of training teachers in the use of behavioral objectives. The high correlations between the Observation scores and the mean Students' Achievement scores for each subject suggest that the training may have influenced the classroom behavior of the instructors, but this was not reflected in the students' achievement scores. In any case, it is clear that when teachers behave as though they are using objective-based instruction, student achievement improves. Stated another way, if the parameters set by objective-based instruction are followed in teacher behavior, more learning appears to occur. The difficulty in demonstrating this effect experimentally lies in the fact that human behavior cannot easily be manipulated, especially in short-term controlled settings. Further study is needed in identifying these "facilitative" behaviors, exploring whether and how they can be promoted, and, finally, whether or not they do in fact improve instruction. It is critical that we fully describe the factor before we attribute to it an effect.

Summary and Conclusions

The present report has found that while contemporary instructional systems assume the use of some form of performance objectives, empirical support to justify their use is lacking. The vast number of studies on the topic demonstrate an contradictory three-way split among achievement increment, decrement, and no effect. However, the intuitive desirability of objectives and positive affective data have provided objectives the support they need for continued use.

The research and rational exercise contained in this report offers a partial explanation of why such confusing results have plagued efforts to demonstrate the effect of objectives. It was first contended that neither the function nor the form of performance objectives have been operationally defined. Of the studies reviewed, ambiguous definitions eliminated the possibility of replication with even minor generalization. The dependent measures also varied widely, ranging from teacher behavior to student affect and achievement, precluding the possibility of any practical conclusions (save those regarding research methods). Thus, research has yet to provide an empirical demonstration of objectives' function.

As to the form of objectives, all agree that it is necessary to state explicit behaviors, conditions, and criteria (standards). Argument begins in determining what is considered explicit. Researchers addressing this issue have attempted to compile "recommended lists" of verbs to be used in objectives, and it is this kind of data which provided a springboard for the first five studies, which were designed to examine the form of objectives.

Study 1 supplied us with normative data regarding the "observability" of 99 frequently recommended verbs, a replication of Deno and Jenkins (1969).

The results confirmed their findings, but carried with them, as had previous studies, the implication that the verb is the only part of the objective worth considering.

Study 2 began an examination of the effect of other parts of the objective, i.e., conditions and/or criteria, on the already established "observability" of the verbs in Study 1. Both components were found to affect the nature of the objective as well as the perceived precision of the verb, often in a highly significant manner.

Study 3 further developed the role of the three components of performance objectives. These data suggested that the observed precision of an objective results from an interaction of all three parts, and that analyses of the components in isolation are meaningless.

The search for unaccounted-for variance in the overall observability of objectives led to an examination of yet another segment, the direct object. The objectives employed in Studies 1 through 3 used an abstract direct object ("x" or "y") in order to minimize differential effects. In Study 4, direct objects varying in judged degree of specificity were incorporated into the objectives and tested for their specific and general effects. The direct objects were found to contribute important additional information to the reader in terms of both observability and precision, following the linear relation anticipated by the gradations in specificity. Interestingly, comparisons of objectives with either abstract or concrete direct objects produced no overall significant difference, suggesting that readers had naturally substituted concrete modifiers for the abstract direct objects in order to "complete" the objective. An acceptable performance objective, therefore, should contain not only a verb denoting an observable behavior,

but also appropriate behaviors, or verbs and direct objects of the inferred mediating objects.

The fifth study represented an attempt to determine whether or not the previous results could be extended to a specific target population of military personnel (both trainees and trainers). Quite simply, the similarity of the military personnel responses to those of the earlier studies (college students) on the verb rating tasks strongly supported the generalization of conclusions. Further information on the validity of interactive effects will be required to provide a broader statement of transferability.

The final study in this report constituted yet another ill-fated attempt to surface an observable function of objectives. Ammons (1971) satisfactorily warned the alchemists failed no matter how often they tried, but that their 'scientific' probes new reasons for their failure, and they tried again. Indeed, through the haze of misspecification, a couple of glimmers were seen. The observers in this study were used to make judgments on the clarity with which the teacher disseminated the information. While one supposes that teachers employing objectives would behave with corresponding precision, such was not the case. Nevertheless, it was discovered that the trained observers could effectively identify those groups which would not likely achieve. The presence of performance objectives was already less important than the behavior assumed to be associated with the use of objectives. While this finding is by no means surprising, it may suggest that researchers should abandon the methods currently in vogue in studies designed to ascertain the function of objectives in instruction. It is unlikely that any study will profoundly alter the basic teaching behaviors of the subjects. Even if a

researcher did take great pains to provide a comprehensive training, there would be no guarantee that the comparison group would not have received similar "objective-based training" by conventional means.

Epilogue: When it doesn't work out empirically, rationalize

To continue elaborating on the above would force us to go beyond the data. Thus, clearly demarcated, the following brief analysis is a rational defense for the use of performance objectives.

The complaints which reasonably well-motivated students most often make about courses fall into three main categories: (a) they do not understand what is going on, (b) they perceive the course as being too much work, and/or (c) there are components in the instructional environment which are either frustrating or unjust. Objectives provide a direct and positive means for reducing or eliminating all three. The use of objective-based training, or the systems approach, automatically excludes the first complaint because the student either lacks the necessary prerequisite knowledge and is denied admission until this deficiency is removed, or the "objectives" themselves are ambiguous or incomplete, a circumstance which the instructor must rectify. The systems approach also addresses the second class of complaints: all good instruction is learner-paced, or the instructional system must be adaptive to the learner. In addition, objective-based instruction tends to be simpler (though we have no empirical evidence for this assertion), a phenomonen which may be a byproduct of clearer thinking. Furthermore, this "simple" quality would obscure sought-after differences in empirical research. Finally, performance objectives help eliminate

frustration and unfairness because of (a) reduced test threat, (b) apparent concern for the student by the instructor (affective), (c) determination of a starting point, content, and a realizable end, and (d) equal requirements (explicitly stated) for all.

The question remains, "Do objectives facilitate learning?" The rational response would be, "...more research is not needed to establish a clear positive relation between objectives and good instruction." However, both rational thought and the empirical evidence presented in this report suggest that work is needed in the area of teacher or instructor training to promote the behavior induced by the effective use of performance objectives.

APPENDIX

This is a study designed to determine the extent to which various words are labels for behavior which is directly observable. For example, most would agree that the verb "to hit" labels behavior which you can see, while the verb "to believe" labels an internal state which cannot be directly observed.

On the subsequent pages you will find a list of action words, or verbs. Your task is to rate each word on a scale from 1-5 from most observable to least observable as follows:

Most Observable least Observable

1 2 3 4 5

to hit

to believe
to sympathize

to bite

Words such as "to hit" and "to bite" are to be given a rating of 1, while words such as "to believe" and "to sympathize" are rated as 5.

Many of the words may not in your judgment be rated 1 or 5, and these you are to rate as 2, 3, or 4 as you see fit.

Remember, the rating you give is determined by the extent to which you judge it possible to observe the behavior.

PLEASE PLACE THE NUMBER WHICH YOU GIVE AS A RATING IN FRONT OF THE WORD.

Please write the number of the month and date of your birth, plus the last two digits of your Social Security number, on the line below:

_____ _____ ____
Month Date S.S. #
(Last 2 digits)

This six digit code preserves your anonymity. It also enables us to pair results of today's questionnaire with a later one, should that become necessary.

Thank you!

____ to reason to

____ to state

____ to see

____ to test

____ to utilize

____ to order

____ to group

____ to understand

____ to thank

____ to solve

____ to select

____ to recognize

____ to round off

____ to shade

____ to summarize

____ to total

____ to use

____ to like

____ to walk

____ to tell what

____ to think critically

____ to subtract

____ to realize fully

____ to regroup

____ to say

____ to supply

____ to take away

____ to underline

____ to write

____ to wonder

____ to learn

____ to read

____ to add

____ to analyze

____ to be curious

____ to count orally

____ to change

____ to concentrate

____ to develop

____ to determine

____ to draw

____ to complete

____ to check

____ to appreciate

____ to arrange

____ to apply

____ to become competent

____ to circle

____ to choose

____ to evaluate

____ to distingyish

____ to discriminate

____ to divide

____ to convert

____ to construct

____ to cover with a card

____ to borrow

____ to average

____ to acknowledge

____ to cross out

____ to connect

____ to create

____ to demonstrate

____ to discover

____ to be aware

____ to deduce

____ to give

____ to identify

____ to locate

____ to multiply

____ to place

____ to read orally

____ to perform

____ to point to

____ to make

____ to line-draw

____ to inquire

____ to finish

____ to find

____ to identify in writing

____ to lower press

____ to match

____ to name

____ to partition

____ to remove

____ to play

____ to number

____ to mark

____ to know

____ to generate

____ to feel

____ to fill in

____ to infer

____ to label

____ to measure

____ to put on

____ to perceive

____ to repeat orally

References

Ausubel, D. P. Educational Psychology: A cognitive view. New York: Holt, Rinehart and Winston, 1968.

American Association for the Advancement of Science, Commission on Science Education Newsletter, 1(3): 2-4 (1965).

Baker, E. L. Effects of student achievement on behavioral objectives and non-behavioral objectives. Journal of Experimental Education, 37(1): 5-8 (1969).

Baker, E. L. Beyond objectives: Domain-referenced tests for evaluation and instructional improvement. Educational Technology, 14(6): 10-16 (1974).

Bassett, R. E., & Kibler, R. J. Effects of training in the use of behavioral objectives on student achievement. Journal of Experimental Education, 44(2): 12-16 (1975).

Blaney, J. P., & McKie, D. Knowledge of conference objectives and effect upon learning. Adult Education Journal, 29: 98-105 (1969).

Bloom, B. S., Englehart, M. D., Furst, E. S., Hill, W. H. & Krathwohl, D. R. Taxonomy of Educational Objectives: Handbook 1, Cognitive Domain. New York: David McKay Company, Inc., 1956.

Bloom, B. S. Stability and change in human characteristics. New York: Wiley, 1964.

Bloom, B. S. Learning for mastery. In B. J. Bloom, J. T. Hasting, & G. F. Madaus (Eds.), Handbook on Formative and Summative Evaluation of Student Learning. New York: McGraw-Hill, 1971.

Boardman, E. The effects of advanced knowledge of behavioral objectives on students' achievement in remedial chemistry. Unpublished doctoral dissertation, University of Southern California, 1970.

Briggs, L. J. Handbook of Procedures for the Design of Instruction. Washington, DC: American Institute for Research, 1970.

Bryant, N., Jr. The effects of performance objectives on achievement level of selected eighth-grade science pupils in four predominantly black inner city schools. Unpublisned doctoral dissertation, Indiana University, 1970.

Burns, R. W. Behavioral objectives for competency-based education. Educational Technology, 12(11): 22-25 (1972).

Cardarelli, A. F. An investigation of the effects on pupil achievement when teachers are assigned and trained in the use of behavioral objectives. Unpublished doctoral dissertation, Syracuse University, 1971.

Clingman, Evan E. The impact of teacher and student knowledge of educational objectives on student learning and satisfaction. Unpublished doctoral dissertation, University of Wisconsin, 1972.

Crooks, F. C. The differential effects of pre-prepared and teacher-prepared instructional objectives on the learning of educable mentally retarded children. Unpublished doctoral dissertation, University of Iowa, 1971.

Dalis, G. T. Effect of precise objectives upon student achievement in health education. The Journal of School Health, 40(5): 262 (1970).

Deterline, W. A. The secrets we keep from students. Educational Technology, 8(2): 7-10 (1968).

Deno, S. L. & Jenkins, J. R. On the behaviorality of behavioral objectives. Psychology in the Schools, 6, 18-24 (1969).

Dick, W. & Carey, L. The systematic design of instruction. Glenview, IL: Scott, Foresman and Company, 1978.

Doty, C. R. The effect of practice and prior knowledge of educational objectives on performance. Unpublished doctoral dissertation, Ohio State University, 1968.

Duchastel, P. C. & Merrill, P. F. The effects of behavioral objectives on learning: A review of empirical studies. Review of Educational Research, 43(1): 53-69 (1973).

Eisner, E. W. Educational objectives: Help or hinderance. School Review, 75(3): 250-260 (1967).

Engel, R. S. An experimental study of the effect of stated behavioral objectives on numeration. Unpublished Master's thesis, University of Marylard, 1968.

Gagné, R. M. The Conditions of Learning (3rd ed.). New York: Holt, Rinehart and Winston, 1977.

Gagné, R. M. & Briggs, L. J. Principles of Instructiona Design (2nd ed.). New York: Holt, Rinehart and Winston, 1979.

Gerlach, V. S., Sullivan, H. J., Baker, R. L., & Schutz, R. E. Programming the instructional film. Audiovisual Communication Review, 14(3): 383-406 (1966).

Gerlach, V. S., & Ely, D. P. Teaching and media: A systematic approach. Englewood Cliffs, N.J.: Prentice-Hall, 1971.

Gerlach V. S., & Ely, D. P. Teaching and Media (2nd ed.). Englewood Cliffs, N.J.: Prentice-Hall, 1980.

Harlen, W. Formulating objectives -- Problems and approaches. British Journal of Educational Technology, 3(3): (1972).

Hempel, C. G. The theoretician's dilemma: A study in the logic of theory construction. In Hempel, C. G., Aspects of Scientific Explanation, Glencoe, Illinois: Free Press, 1965.

Illich, I. Retooling Society. In T. Morrison & A. Burton (Eds.), Reforms and Alternatives for Canadian Education. Toronto: Holt, Rinehart and Winston, 1973.

Jenkins, J. R., & Deno, S. L. Influence of knowledge and type of objectives on subject matter learning. Journal of Educational Psychology, 62(1): 67-70 (1971).

Kapfer, P. G. Behavioral objectives and the curriculum processor. Educational Technology, 10(5): 14-17 (1970).

Kibler, R. J., Barker, L. L. & Miles, D. T. Behavioral Objectives and Instruction. Rockleigh, N.J.: Allyn and Bacon, 1970.

Kibler, R. J., Cegala, D. J., Barker, L. L. & Miles, D. T. Objectives for Instruction and Evaluation. Boston: Allyn and Bacon, 1974.

Lawrence, R. M. The effects of three types of organizing devices on academic achievement. Unpublished doctoral dissertation, University of Maryland, 1970.

Lindval, C. M. The importance of specific objectives in curriculum development. In Lindval, C. M., Defining educational objectives. Pittsburgh: University of Pittsburgh Press, 1964.

MacDonald-Ross, M. Behavioral objectives -- A critical review. Instructional Science, 2(1): 1-52 (1973).

Mager, R. F. Preparing Instructional Objectives. San Francisco: Fearon Publishers, 1962.

Merrill, M. D. Necessary psychological conditions for defining instructional outcomes. Educational Technology, 11(8): 34-39 (1971).

National assessment of educational progress. Denver: The Education Commission of the States, 1972.

Olson, G. H. A multivariate examination of the effects of behavioral objectives, knowledge of results, and the assignment of grades on the facilitation of classroom learning. Unpublished doctoral dissertation, Florida State University, 1971.

Piatt, R. G. An investigation of the effect of training of teachers in defining, writing, and implementing educational behavioral objectives has on learner outcomes for students enrolled in a seventh-grade mathematics program in the public schools. Unpublished doctoral dissertation, Lehigh University, 1969.

Popham, J. Objectives and instruction. In AERA Monograph on Curriculum Evaluation, Volume 3. Chicago: Rand McNally, 1969.

Popham, W. J. & Baker, E. L. Establishing Educational Goals. Englewood Cliffs: Prentice-Hall, 1970.

Smith, S. A. The effects of two variables on the achievement of slow learners on a unit in mathematics. Unpublished Master's thesis, University of Maryland, 1967.

Stedman, C. H. The effects of prior knowledge of behavioral objectives on cognitive learning outcomes using programmed materials in genetics. Unpublished doctoral dissertation Indiana University, 1970.

Sullivan, H. J. & Niedermeyer, F. C. Prospects for school acceptance of objectives-based instructional programs. Educational Technology, 17(6): 20-25 (1977).

Tiemann, P. W. Student use of behaviorally-stated objectives to augment conventional and programmed revisions of televised college economics lectures. Paper presented at the annual meeting of the American Educational Research Association, Chicago, 1968.

Tiemann, P. W. Conceptual objectives for domain-referenced education. Educational Technology, 17(5): 21-22 (1977).

Tyler, R. W. Constructing Achievement Tests. Columbus: The Ohio State University Press, 1934.

Weinberg, H. Effects of presenting varying specificity of course objectives to students on learning motor skills and associated cognitive material. Unpublished doctoral dissertation, Tempe, Arizona: Arizona State University, 1970.

Yelon, S. L., & Schmidt, W. H. The effect of objectives and instructions on the learning of a complex cognitive task. Paper presented at the annual meeting of the American Educational Research Association, New York, 1971.